



COGNITE



FRAMO
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The Future of the Field: Performance-Based Contracts Disrupt the Oil & Gas Value Chain



EXECUTIVE SUMMARY

Digitalization is about the transformation of business models and activities through the strategic use of digital technologies. It's also the most pressing challenge for many Original Equipment Manufacturers (OEMs), especially those with decades of experience and domain knowledge behind them.

A "challenge" can be thought of three ways:

01

As a call to participate in a competitive contest or fight;

02

As a situation that will test our abilities and strengths;

03

And as an attempt to win the next level in a competition.

Framo, a global market leader in pumping systems for the marine industry, has decided to take on the challenge of digitalization in every sense of the word.

For more than five decades, Framo has been manufacturing, supplying, and servicing their systems globally. They are known for setting standards with their pump technology and they've built a reputation for both innovative excellence and quality assurance. And somehow they've done all this without having access to the live operational data generated by their pumps in the field. That data remained in the sole possession of the customers who have purchased and operated Framo's pumping systems.

Now things are changing. The value of industrial data is increasing, particularly for those companies who recognize the potential for sharing that data with trusted partners. To take their competitive edge to the next level, Framo is focused on data-driven solutions fueled by access to live operational data from their own pumps. Ready to disrupt legacy business models and change the way OEMs work with operators.

Framo has supplied and serviced pumps for Aker BP on the Norwegian Continental Shelf for many years. Aker BP is the largest independent oil and gas operator in Europe, and their vision for the field of the future has sent ripples across the value chain. It's an inspirational moonshot: an autonomous platform, unmanned and smart enough to make decisions that optimize production. A future made less distant by advanced technologies and the company's dogged determination to extract the maximum value from digitalization.



In this spirit, Aker BP offered Framo access to their live pump data for the first time, and Framo agreed to actively support Aker BP in its operation and maintenance of the pump system. Together, they hammered out a new pricing model tied to the improved performance of the pumps. The SMART contract signed by the two parties includes a measurable set of targets that requires risk and offers reward on both sides. To be proven by the data.

Live operational data presents the opportunity for condition monitoring and, subsequently, predictive maintenance. It also empowers companies like Framo, who already maximize their innovative capacity based on testing data or isolated data sets collected by the operator, to further improve their products. Better still, when Operators and OEMs share data, they enhance their ability to communicate with one another. This makes collaboration easier and can also lead to deeper trust and loyalty.

Aker BP's willingness to share this data inspired Framo to seize the opportunity to push forward with their own digitalized vision: to shape **the future of the field**. Because even as digitalization changes the way we work, it doesn't change what each company does best. In fact, with live operational data, Framo is prepared to prove that OEMs can reinforce their domain expertise. Demonstrate new business models, beginning with smart contracts. And reimagine competition in a thriving industrial ecosystem nourished by open data.

It's almost impossible to predict what the landscape of the Oil & Gas sector will look like in the next five to ten years. The challenges of digitalization will cause some players to rise and others to fall. Though uncertain of what the full value of data openness will be, Framo is sure the value exists. They've accepted the challenge with a plan to stand at the forefront of the digitalized future.



INTRODUCTION

In August 2018, Framo signed one of the first performance-based contracts on the Norwegian Continental Shelf with Aker BP. This paper will take a close look at the specifics of the contract and at the collaboration behind it, considering the risks and rewards for Aker BP, Framo, and Cognite, whose cloud-native industrial data platform makes the necessary data sharing simple, secure and scalable.

Specifically, the goal of the Aker BP-Framo contract is to change the traditional approach to pump maintenance. The continuous flow of live offshore data to the pump supplier allows for onshore monitoring of equipment, replacing unnecessary scheduled maintenance activities with essential maintenance when needed. To understand the full impact of this new business model, we need to look back in time.



THE WORLD OF YESTERDAY

Pump reliability is a top priority on an offshore platform. Framo's seawater lift pumps on Aker BP's Ivar Aasen platform operate continuously, pumping sea water up through a cooler top-side to cool process plant equipment. These pumps are designed to withstand the harsh conditions of the North Sea environment and are manufactured to ensure low maintenance requirements and long life.

The Framo Service Cycle

Framo retains full control over the production of their pumps, from design through manufacturing at a single plant in Flatøy, Norway. This includes full-scale testing and quality control. Framo tests their systems at rated capacity, pressure and speed, and performs additional qualification testing on critical components. The data collected in testing has previously been a core basis of innovation and improvement for Framo.

They provide support through the installation and commissioning of their pumps and follow that up with scheduled and on-call response service throughout the project's lifetime. Framo believes downtime is unacceptable, so they have engineers on-call around the clock and around the world.

Finally, Framo offers experts to train their customers on how to understand, use, monitor, and service the pumping systems. Training is comprehensive and followed up with regular service bulletins to provide tech updates and operator tips.

In the case of Aker BP, if a worker noticed an issue with a Framo pump on Ivar Aasen outside the preset maintenance schedule, that worker would first need to seek approval from his or her superiors, then submit a work order request to Framo. This meant Framo only saw their operational equipment on their scheduled rounds or when something was already going wrong.

That's what drives this digitalization initiative to change the OEM-Operator business model: the potential to combine forces to optimize production, maximize the lifespan of existing equipment, improve sustainability, and to see what's going to go wrong before it goes wrong.

Today, Aker BP uses a variety of technologies to monitor the current state of their equipment based on historic and real-time data. They perform **condition-based maintenance** on their pumps, reducing downtime risk due to equipment failure by responding to alerts when equipment is operating outside the preset normal range. What they want to do is predict the future state of their equipment, using all the information at their disposal to calculate equipment breakdown ahead of time and schedule the appropriate intervention.

This is called **predictive maintenance**, and it represents the potential for enormous cost savings, as well as the benefits of increased efficiency and safety. To do it successfully requires the deft handling of extremely large data sets and the sharing of live data with those to whom it means the most. In this case, that means allowing Framo to see how their pumps operate in the field, so they can use their expertise to develop the best algorithms based on the best data.

THE WORLD OF TODAY

The Ivar Aasen field is located in the northern part of the North Sea. Aker BP's Ivar Aasen platform provides more than just oil. It also transmits vast volumes of data back to their onshore monitoring control room in Trondheim, roughly 1,000 km away. The interpretation of these data has made Ivar Aasen one of the most technologically advanced platforms worldwide.

Previously, the operational data from Ivar Aasen was only available to Aker BP. But in 2017, the company contracted with Cognite--a Norwegian software company setting the standard for the industrial data platform--to ingest the operational data from all five of Aker BP's assets on the NCS in real time.

The Cognite Data Platform

The Cognite Data Platform offers the capability to liberate a wide variety of industrial data from separate, siloed source systems and collect it in one place, automatically and without space limitations. The CDP then structures sensor data in relation to process diagrams, production information, 3D-models, and event data (maintenance, incidents). Cognite calls this functionality Contextualization. Everything linked in the real world is also linked in the platform.

By organizing Aker BP's industrial data this way, connecting relevant data to one another, Cognite presents a digital representation of Aker BP's industrial reality, both historical and real-time. From there, Aker BP can run stronger machine learning applications for optimization and automatization, as well as human-facing applications, such as advanced visualizations and apps for the digital field worker. With the contextualized data in the CDP, Cognite also created a full digital twin of the Ivar Aasen including Framo's pumps.

For the first time, any authorized user at Aker BP could get a complete overview of the functioning platform, could zoom in and see the way individual equipment was performing, could understand the way the real world was connected. The insights drawn from these enriched processes and resources are more powerful and actionable. And the benefits of these insights and actions extend beyond Aker BP.

The Cognite Data Platform is designed with this kind of openness in mind. Unlike the legacy infrastructure and systems often used by large industrial companies, the CDP is modern (i.e., no more point-to-point integrations) and flexible. Built on a cloud infrastructure, the CDP allows a client to open selected data to specific, authorized users with a simple log-in. It's also fast, streaming the desired data with low latency, without sacrificing security. Data is encrypted both at rest and in transit.

Aker BP and Framo each have their own "tenant" in the CDP, a sovereign space where they securely store their own data. Cognite makes it straightforward to choose what to share between them. The appropriate data--which Aker BP continues to own--is duplicated in Framo's tenant.

"With Cognite making live and contextualized data available, we at Framo are able to create our own 'apps' and models to predict the status of our equipment at Ivar Aasen. This allows us to efficiently plan maintenance and anticipate the life cycle of our pumps" -- Trond Petter Abrahamsen, Managing Director of Framo Services AS

As a pilot, Aker BP and Framo are using the live operational data (sensor data on temperature, pressure, flow, etc.) from Ivar Aasen as the foundation for a new SMART contract.

SMART Contract Parameters & Goals

The topic of performance-based contracts has been on the minds of Oil & Gas industry leaders for some time. But revolutionizing such long-standing business models requires a commitment by everyone involved to let data drive the decisions. To ground the concept in what is specific and measurable.

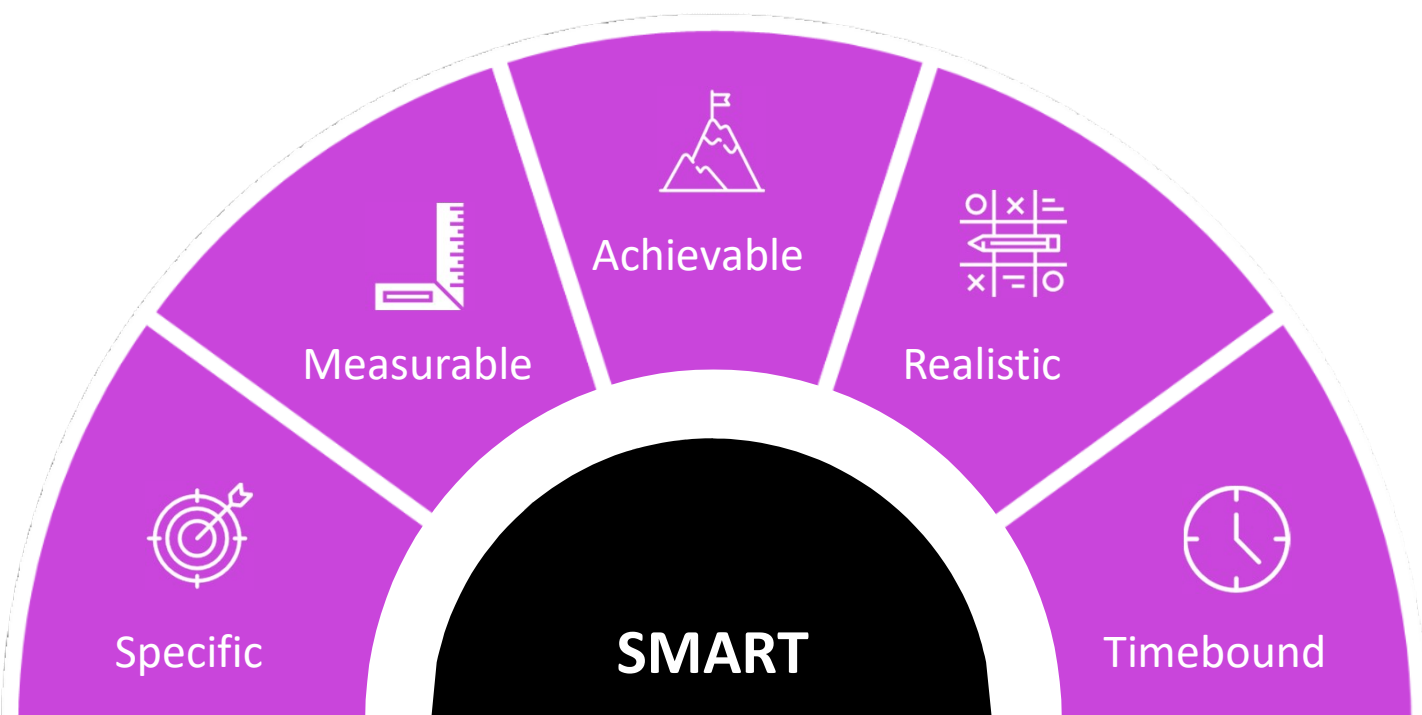
To support Aker BP's vision of unmanned platforms, Framo has agreed to embrace the digitalization of relevant technical interfaces and services. This way, they can move from their regular scheduled maintenance agreement to one that relies on predictive maintenance.

Using the CDP, Framo will monitor their own pumps on Ivar Aasen and analyze that live operational data to predict the need for maintenance and repair.

The initial contract will run for six months and will include diagnosis, troubleshooting, service, parts and total maintenance for Framo's seawater lift pumps on the Vallhall and Ivar Aasen platforms (five pumps total). Non-foreseen breakdown is not be addressed under this contract.

The price is fixed, based on performance attached to a list of defined KPIs. The targets selected by the two parties reflect a nuanced consideration of risk and reward on both sides. Aker BP and Framo have found a way to share responsibility on two key fronts: maximizing pump uptime and optimizing pump performance.

Aker BP wants their pumps up and operating as long and as efficiently as possible. This includes **avoiding overall pump breakdown**, which is an extremely expensive scenario. But the SMART contract specifies more than basic condition monitoring and maintenance.



Aker BP will operate each pump within an agreed upon operating range and perform a basic maintenance routine, including the replacement of filters and monitoring of oil levels, etc. Framo will use the conditional data on their equipment plus the operational data supplied by Aker BP to reinforce their machine learning models and strengthen their algorithms for **predictive maintenance**. A possible bonus is built into the pricing of the contract that hinges on the **increased accuracy of Framo's algorithms**, an additional incentive for Framo to be proactive and creative in their use of the live pump data.

Based on their knowledge and expertise, Framo will also advise Aker BP on how to improve equipment performance by changing the way they operate the pumps. This is meant to **lengthen the time period between maintenance** overhauls, which results in cost savings. But the contract goes even further. Built into the KPIs is a shared responsibility for **sustainability**, minimizing environmental impact and energy consumption for the pump system. The initial six-month period of this pilot contract will be used to establish a baseline for energy consumption, which will provide a foundation for future targets to improve on that score. Aker BP also agrees to take a series of oil samples and share that data so that Framo can monitor trends and supply valuable feedback.

The KPIs in the SMART contract reflect these goals and officially make them the joint responsibility of Aker BP and Framo

SMART Contract Use Cases

In the three months preceding the signing of this contract, Aker BP and Framo worked together to identify two achievable, realistic use cases for the pilot period. The first has to do with an oil filter in the seawater lift pumps.

Lubrication oil in the pump goes through this filter. Tests are run on the pump to measure a pressure drop. The test is looking for a clog, indicated by a major drop in pressure. When the operators see this pressure drop, they know the filter needs to be changed. Previously, this was done only based on scheduled maintenance, which resulted in a number of filter changes that were unnecessary.

Aker BP had the data to complete analysis, but they lacked the domain expertise to identify and react to insights. Framo, the pump experts, can create better models than operators can. Given access to live operational data on their oil filters, Framo can tell when to change the filters. The hypothesis is that the filters can be changed later in the life cycle than they have been historically. This will also allow Aker BP to anticipate standard operations such as oil or filter changes with greater accuracy, empowering them to be organized and efficient about planning for the expensive, complex process that surrounds these procedures.

The second use case is about data visualization. There is a well-known range of flow and pressure within which pumps should operate. Framo plots this data based on time series as a cluster of dots on a chart. They use a classifications graph to figure out how their pumps are performing. But until now, this methodology was only used in the testing phase at their own plant. Never in operations.

Using the live operational data from Aker BP, Framo can create the same set of charts for the pumps on Ivar Aasen and Vallhall. And they know what they're looking for: a cluster of dots in the ideal area on the chart. When they see something different, they can alert Aker BP and advise operational changes to improve performance. Or, if necessary, schedule a pump visit.

The motivation behind this groundbreaking new business model is clear for Aker BP: predictive maintenance and the associated cost savings. For Framo, the goal is a little less clear. And yet, no less enticing.



THE WORLD OF TOMORROW

Leadership in any field comes with responsibilities. Aker BP and Framo have accepted the challenge of digitalization with determination and open minds. Their first truly data-driven contract with one another tests the waters. By choosing to be the first movers in this space, they get to ask the important questions and help to redefine the important terms. In this case, **What does it mean to Control your equipment? What does it mean to Own your data?**

What does it mean to Control your equipment?

For too long, OEMs have been relegated to a passive position regarding their own equipment. With decades of domain experience behind them, equipment experts like Framo have been expected to hand over control of their products at purchase. Then sit back and hope that the operator will do things optimally. Waiting for something to go wrong.

Framo sees where the market is going. Innovation is necessary. They already have the best pumps in the world and want to remain in that position. Their performance-based contract with Aker BP is the first step toward a greater paradigm shift: from product to service.

One day, it may be possible for Framo to offer the option of a “pump-as-a-service” contract. An operator would be able to lease Framo’s pumps for a period of time. Framo would retain more monitoring responsibilities. To do this, they would need a full digital representation of their pumps, a comprehensive digital twin including all kinds of contextual data. Not just performance-related data, such as the time series-based pressure and flow data or oil analysis data specified in their current SMART contract with Aker BP. But also information from the operator’s control system. In real time.

Because sensor data without operational context is incomplete and can lead to inconclusive insights. When someone in the control room turns on a pump, heat is generated inside the pump. If the worker turns the pump off and on again, more heat is created. Do this enough times, the pump will break. Sensor data will only show that the heat rose and rose and rose until the pump shut down. Something went wrong. Only operational data connected to the sensor data will reveal cause.

Pump-as-a-service would likely save operators a lot on the bottom line. For OEMs like Framo, the opportunity to have complete control over their equipment could mean huge advancements in innovation on that equipment, as well as strengthened machine learning models to understand equipment behavior and capacity. All driven by super-enriched live data.

As a business model, pump-as-a-service hasn’t yet been proven superior to what has come before. But it feels possible. Framo’s partnership with Aker BP might just prove it.

What does it mean to Own your data?

Data ownership is a sensitive issue. The instinct has been to barricade data in the name of security. Shut it away where only you can see it.

The primary problem with that instinct is that locking down your data and only handling it yourself will severely restrict potential insights and limit potential value.

Aker BP owns all their operational data. Today, that means 600,000 time series, 1.3 trillion data points, 400,000+ documents, 2,000 P&IDs, and 4 million events collected from all five operational assets on the NCS and contextualized in the Cognite Data Platform. Only a small subset of that data is relevant to the SMART contract with Framo.

Driven to realize the true capacity of their own data, Aker BP has decided that data ownership means the prerogative to touch it, consider it, use it. To utilize advanced technologies to make sense of it. To partner with companies like Cognite to make strategic data sharing work for their business. To share live data with trusted partners like Framo to enable new business models and accelerate innovation on the product side.

That’s data ownership.

By the same token, Framo will now use the stream of live operational data from Aker BP to train their existing machine learning models. Leveraging machine learning and advanced analytics toolkits, Framo can speed up the development of their models, making them stronger and increasing the possibility of a bonus in the SMART contract with Aker BP.

But the models belong to Framo. All Framo's intellectual property remains secure and in their control.

Thankfully, technology has advanced to empower this evolution of thinking about data ownership. The Cognite Data Platform offers a simple, straightforward, secure way to collect and store data as a comprehensive set in the cloud. Cognite's customers can then provide selected partners authenticated access to specific data sets using an API key, allowing swift integration and powerful interoperation.

Because data-driven decisions are better than decisions made without all the data. And when every player in a shared ecosystem has access to the right data at the right time, the whole ecosystem wins.

Which brings us to another important revelation based on the collaboration between Framo, Aker BP and Cognite.



CALL TO ACTION: CREATING THE IDEAL ECOSYSTEM

Framo manufactures, delivers and services pump systems for the marine industry. Aker BP produces oil and gas. They are experts in their respective fields. Neither are IT companies.

To capture the full value of the digitalized future, companies like Framo and Aker BP need to use data in new ways. The technology to do so is available, but it requires a complex infrastructure to make it work quickly, securely, and at scale. This is a pure IT/software problem and calls for a company that specializes in solving it.

Cognite knows data platforms. How to make data accessible, readable and valuable. How to make sharing the right data between parties as easy as possible. We know data the way Aker BP knows oil and the way Framo knows pumps.

The digitalized future will be defined by this kind of ecosystem. Where each player has the chance to specialize and deliver their own best product or service. And where each is open to sharing necessary data with one another to increase collaboration and make interoperation and innovation even easier.

Freed from the impossibility of fully understanding another domain (e.g., IT and big data handling), Framo can spend their valuable time and resources focused on reinforcing their position as a global market leader in pump systems. They can innovate based on high quality operational data and make strategic decisions for their future, including the embrace of new business models. They can amplify their own competitiveness by collaborating where it counts. They can shape the future of their field.

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